Office of Aero-Space Technology (Code R)
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The total Fiscal Year 2001 budget request for the Aero-Space Technology Enterprise is $1,193 million.

The Aero-Space Technology Enterprise's responsibility is to provide revolutionary advancements in science and technology that sustain global U.S. leadership in civil aviation and space.

Two new focused research programs have been added, and there is a major new initiative, the Space Launch Initiative, a key element of the Agency's Integrated Space Transportation Program. As a result of these changes, the Enterprise will be able to accelerate its efforts to achieve its access to space goals and continue active programs associated with noise reduction and the invigoration of the general aviation industry. The new focused research programs include:

Small Aircraft Transportation System (SATS): The objective of SATS is to develop and demonstrate technologies for small aircraft that will enable safe, efficient use of these aircraft at small, public-use airports. Community vitality and economic opportunity are dependent on access to the high-speed transportation afforded by small aircraft. Building on NASA's success in developing general aviation technologies, most notably the Advanced General Aviation Transport Experiments project, SATS addresses the technical barriers that have impeded growth in this area: safety of flight and accessibility to underutilized public-use facilities. SATS will develop the vehicle and the infrastructure technologies to improve safety by reducing the accident rate of small aircraft to that of commercial transports; utilize the nation's under-used airspace and landing facilities at non-hub airports in all weather conditions; and increase capacity for efficient operations of commuter, regional and runway-independent aircraft at hub airports.

Quiet Aircraft Technology: This focused program will build upon the highly successful noise reduction efforts that were begun in the Advanced Subsonic Transport (AST) program and maintain the progress toward meeting the Enterprise's noise reduction goal. The achievement of these goals will lead to a noise-constraint-free air transportation system with the objectionable aircraft noise being contained within airport boundaries. The AST noise reduction milestones will be completed on their original schedule as part of this focused technology effort.

2nd Generation RLV Program: 2nd Generation RLV is aimed at implementing a central tenet of the National Space Policy: the transition of routine space activities to the private sector to concentrate NASA resources on high-leverage science research, technology development, and exploration activities. By 2005, NASA will conduct a

competitive launch services procurement to support the launch requirements of both robotic and human spaceflight operations. The objective will be to dramatically improve safety while significantly reducing the cost of such launch services, thus eliminating the current need for the Government to own and operate a full system.

The 2nd Generation RLV program will substantially reduce the technical, programmatic and business risks associated with developing a safe, reliable and affordable 2nd generation RLV architecture. The program will invest in the technology development, business planning, design and advanced development efforts to enable at least two competitive options for a new architecture. The program will be implemented to assure that the full-scale development of any new systems can be initiated no later than 2005. The 2nd Generation RLV FY 2001-2005 program will be divided into four major investment areas: Systems Engineering and Requirements Definition, RLV Competition and Risk Reduction, NASA Unique Systems and Alternative Access.

In FY 2001, the 2nd Generation RLV Program will solicit industry in the areas of Systems Engineering and Requirements Definition, RLV Competition and Risk Reduction and NASA Unique Systems. Current planning calls for industry to respond to NASA by October 2000, with proposals consistent with the program objectives. Multiple contract awards are planned for January 2001. NASA centers will contribute to the effort according to their areas of expertise and in accordance with an overall integrated industry/NASA approach. The competing concepts must address NASA requirements while optimizing the convergence with commercial opportunities. Industry and government partnerships will be established to assure that the ownership and availability of technological advances will be with the implementing contractors.

The fourth program element, Alternative Access, seeks to take advantage of all potential sources of access to space on U.S. launch systems to meet the Agency's requirements. This element supports use of existing and emergent commercial launch vehicles that could meet Space Station requirements. NASA will use the Next Generation Launch Services (NGLS) acquisition as a means to develop contractual relationships with multiple emerging U.S. vendors to meet this objective. These contracts will be for fixed-price services for indefinite delivery-indefinite quantity launch contracts.

This acquisition is targeted to take advantage of commercially developed launch systems that to date have little to no demonstrated flight experience. Contracts are targeted for award later in 2000, with first launches feasible within 12-18 months of contract award, dependent on readiness of commercial launch services. Funds will also be used to accommodate definition of mission unique requirements for candidate science and space station missions, in advance of launch service commitments. As the NGLS acquisition develops, NASA envisions the funding for this effort transitioning from the Aero-Space technology appropriation to the Human Space Flight (HSF)

appropriation, because HSF is the lead organization for the NGLS acquisition and manages the International Space Station program.

Aero-Space Base $539.4 million

NASA's Aero-Space Base serves as a vital foundation of expertise and facilities to consistently meet a wide range of aeronautical and space transportation technology challenges for the nation. The Aero-Space Base is intended to provide a high-technology, diverse-discipline environment that enables the development of new, revolutionary, aerospace concepts and methodologies for applications in industry. The Aero-Space Base has an objective to develop revolutionary concepts, highly advanced, accurate computational tools, and breakthrough technologies that can reduce the development time and risk of advanced aerospace systems. These concepts, tools and technologies contribute to one or more of the Aero-Space Technology Enterprise goals and lay the foundation for future focused programs to address these goals: Global Civil Aviation, Revolutionary Technology Leaps and Low Cost Access to Space.

The Aero-Space Base is a framework of seven customer-driven programs that serve the needs of the full range of aerospace vehicle classes. The seven Aero-Space Base programs are:

Information Technology: In FY 2001, the Information Technology Base program will demonstrate an environment for aerospace hardware design that will provide real-time access to flight simulation data during a flight simulation test, with computational simulation data available as input to the flight simulation. This research will provide a capability for assessment of design impacts on aerospace vehicle controls and handling qualities earlier in the design cycle, leading to reduced design costs and improved design.

The Intelligent Synthesis Environment (ISE) initiative will research, develop and implement tools and processes to revolutionize engineering practice and science integration in the design, development, and execution of NASA's missions. ISE will create an advanced, networked collaboration of all geographically dispersed entities involved in the life cycle of NASA missions. A diverse set of life-cycle engineering tools -- seamlessly integrated to provide unprecedented computational speed and fidelity -- will be created for selected Enterprise applications. Integrating computer intelligence with engineering and science team decision processes is a fundamental goal.

Vehicle Systems Technology (VST): In FY 2001, the VST program will achieve a healthy balance between activities that contribute to aviation and those that contribute to space transportation. The program will continue to develop technology in the areas of safety, environmental compatibility, general aviation, next-generation design tools and experimental aircraft, and will fully support access-to-space goals. Many important tasks will be completed in FY 2001 for space transportation including the second Mach

7 flight and the Mach 10 flight of the Hyper-X vehicle, and identifying protocols and methodologies for accelerated testing of space transportation materials. New advanced vehicle concepts will be down-selected in 2001 and the Blended Wing Body vehicle will pass integration testing and delivery review.

Propulsion and Power Technology: During FY 2001, the effort to improve engine safety will continue. The Ultra Safe Propulsion project will deliver blade and disk alloys which are more crack resistant and will continue with the development of an improved containment system. Assessment and conceptual design of hybrid engine cycles based on pulse detonation engines, and combined-cycle propulsion systems will be completed. The fundamental aspects of noise generation and propagation, and the identification of advanced noise reduction concepts will continue.

Flight Research: In FY 2001, the Flight Research program will demonstrate a solar-powered remotely piloted aircraft at 100,000 ft. and complete development of a heavyweight energy storage system under the ERAST project. Both achievements will demonstrate technologies that will enable atmospheric "satellites" for commercial use and create the Nation's capability to undertake subsonic scientific sampling high in the stratosphere.

Operations Systems: For FY 2001, the focus of the program will be in technologies in the areas of weather (icing research) and training/countermeasures. The primary emphasis of the icing research will be the development of a ground-based sensor suite to assist in detecting icing conditions. Training research, which is a new thrust, will concentrate on developing an understanding of the causes of errors during concurrent task management, with an eye toward later development of training tools to alleviate this type of error.

Rotorcraft: In FY 2001, the Rotorcraft Program will conduct a vigorous effort to develop technology and transfer it to industry through the FRIAR project, implemented through the National Rotorcraft Program and the Rotorcraft Industry Technology Association. There will be advances made in Rotorcraft crashworthiness, which will demonstrate the ability to mitigate damage to airframe structures due to crash/harsh landings onto both soft and hard surfaces such as soil, concrete, or water. To improve flight safety and lessen the cost of maintenance, new Health and Usage Monitoring Systems (HUMS) protocols will be developed. HUMS will track wear and tear on critical parts as well as sense deterioration and give warnings. Finally, under the SAFOR Project, flight tests will be completed to demonstrate and validate control laws for low pilot workload under typical civil operations involving low-visibility weather conditions.

Space Transfer & Launch Technology: FY 2001 activities will be consistent with the Integrated Space Transportation Plan and guided by comprehensive systems analysis. In-space investments include low-cost upper stage, Earth-orbital, planetary and

interstellar transfer technologies. Upper stage technologies are focused on advanced peroxide-based systems and will demonstrate advanced components, including cooperative participation with the DoD on the upper stage flight experiment. Earth-orbital and planetary investments will focus on the development of high-performance, lightweight propulsion technologies, including solar-electric transfer, lightweight feed system components, planetary aero-assist and on-orbit cryogenic fluid management. Interstellar precursor technology development will focus on development of lightweight solar sail materials. Propulsion activities include the development of a long-life/lightweight rocket engine testbed and an air breathing propulsion testbed.

Aero-Space Focused Program $507.4 million

High-Performance Computing and Communications: In FY 2001, Computational Aerospace Sciences (CAS) will demonstrate 1,000-fold improvements over the FY 1992 baseline in time-to-solution for relevant applications on high-performance computing testbeds. These performance improvements will be partially supported through the demonstration of new software tools to benchmark testbed computing performance, database manipulation, and resources scheduling. Ultimately, the FY 2001 accomplishments by CAS will allow for complete simulation of aircraft engine combustors and compressors in three hours each, high-fidelity space transportation vehicle analysis in one week and database generation for stability and control of aerospace vehicles within one week.

Aviation Systems Capacity: During FY 2001, in the Advanced Air Transportation Technologies project, field evaluations will be conducted to demonstrate transition airspace decision support tools in support of: 1) information exchange between air traffic service providers, airline operations centers and flight crews; 2) conflict resolution. The Civil Tiltrotor project will acquire a comprehensive mission simulation database of integrated cockpit and operating procedures for complex, low-noise flight paths of a civil tiltrotor.

Aviation Safety Program: For FY 2001, Aviation System Monitoring and Modeling will demonstrate, in an operational environment, tools for merging heterogeneous databases to aid causal analysis and risk assessment. System-Wide Accident Prevention will complete development of flight crew knowledge and proficiency standards for automation and deliver them to industry for evaluation. Single Aircraft Accident Prevention will complete the development of a preliminary simulation database, mathematical models, and 6-degree of freedom vehicle simulations to characterize adverse conditions, failures, and loss of control. Accident Mitigation will validate system designs in a fire environment experiment, showing reliability and low false-alarm characteristics. Synthetic Vision will down-select concepts suitable for retrofit in commercial, business, and general aviation aircraft.

Ultra-Efficient Engine Technology: The Ultra Efficient Engine Technology program is planned and designed to develop high-payoff, high-risk technologies to enable the next

breakthroughs in propulsion systems and spawn a new generation of high performance, operationally efficient and economical, reliable and environmentally compatible U.S. aircraft. The breakthrough technologies are focused on propulsion component and high-temperature engine materials development and demonstrations. These breakthroughs will enable future commercial and military propulsion systems that are greatly simplified, achieve higher performance, and have potential for much reduced environmental impact for a broad range of aircraft applications.

Future X – Pathfinder: The objective of the Future-X Pathfinder Program is to flight demonstrate advanced space transportation technologies through the use of flight experiments and experimental vehicles. The Future-X Pathfinder Program will carry out flight demonstrations and experiments with highly controlled and low total cost. The program includes the development and operation of the Pathfinder class X-vehicles (X-34 and X-37) and a number of flight experiments. The X-37 project funds the development and flight demonstrations of a modular orbital flight testbed, which will be the first experimental vehicle to be flown in both orbital and reentry environments.

X-34: The X-34 program will demonstrate technologies necessary for a reusable vehicle, but will not be a commercially viable vehicle itself. It will be a rocket-powered, Mach-8-capable flight demonstrator test bed to close the performance gap between the subsonic DC-XA and the Mach 13+ X-33. The X-34 objective is to enhance U.S. commercial space launch competitiveness through the development and demonstration of key technologies applicable to future, low-cost reusable launch vehicles.

Enabling Space Launch Initiative: By the end of the decade, NASA will conduct a competitive launch services procurement to support the launch requirements of human space flight operations. The objective will be to dramatically improve safety while significantly reducing the cost of such launch services, thus eliminating the current need for the Government to own and operate the full system. In FY 2001, the 2nd Generation Reusable Launch Vehicle (RLV) program will solicit industry in the three major areas of systems engineering and requirements definition, RLV competition and risk reduction and NASA unique systems.

Commercial Technology Programs $135 million

NASA's Commercial Technology Program includes Commercial Programs, Technology Transfer Agents and the Small Business Innovative Research Program. NASA's Commercial Technology Program facilitates the transfer of inventions, innovations, discoveries or improvements developed by NASA personnel or in partnership with industry/universities to the private sector for commercial application leading to greater U.S. economic competitiveness.

The goal of Commercial Programs is to share the harvest of NASA's technology programs with the U. S. industrial/scientific community. The goal encompasses the

commercialization of technology developed in all the Agency's Enterprises, in past as well as current programs.

Aero-Space Technology Investments $11.2 million
The Aero-Space Technology Strategic Enterprise investments in higher education institutions include Federally mandated outreach to the Nation's Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs), including Hispanic-Serving Institutions and Tribal Colleges and Universities.

February 2000